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EXAMINER	
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ART UNIT	**PAPER NUMBER**
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Please find below and/or attached an Office communication concerning this application or proceeding.

PTO-90C (Rev. 07-01)

Office Action Summary	Application No. 10/003,700	Applicant(s) FROLOV ET AL.	
	Examiner Michael H. Caley	Art Unit 2882	

-- *The MAILING DATE of this communication appears on the cover sheet with the correspondence address* --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on ____ .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-77* is/are pending in the application.

4a) Of the above claim(s) ____ is/are withdrawn from consideration.

5)☐ Claim(s) ____ is/are allowed.

6)☒ Claim(s) *1-77* is/are rejected.

7)☐ Claim(s) ____ is/are objected to.

8)☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *02 November 2001* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on ____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. ____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 4 .
4) ☐ Interview Summary (PTO-413) Paper No(s). ____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Drawings

This application has been filed with informal drawings which are acceptable for examination purposes only. Formal drawings will be required when the application is allowed.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1-4, 14, 27-30, 40, 62, 74, and 77 are rejected under 35 U.S.C. 103(a) as being unpatentable over Zenteno (U.S. Patent No. 6,522,450).

Regarding claims 1, 27, 62, Zenteno discloses an optical device having:

an NxN network, where N is an integer greater or equal to 2 having N input ports for receiving optical input energy and N output ports for providing optical output energy (Figure 6 element 130);

(N-1) feedback paths optically coupling (N-1) of the input ports of the NxN network to (N-1) of the output orts of the NxN network (Figure 6 element 580);

a first optical waveguide for receiving an input optical signal, said first optical waveguide being coupled to a remaining one of the input ports of the NxN network (Figure 6 element 131);

a second optical waveguide for the exit of an output optical signal, said second optical waveguide being coupled to a remaining one of the output ports of the NxN network (Figure 6 element 132); and

an active element selectively supplying gain or loss to optical energy in at least one of the feedback paths (Figure 6 elements 580 and 582; Column 9 lines 8-12).

Zenteno fails to disclose the optical output energy at each of the output ports as arising from interference among the optical input energy received at the input ports. Zenteno teaches a coupler (Figure 6 element 578) with a coupling ratio determining the portions of the optical pulse that are coupled into the feedback path of the ring and the portions that are coupled directly away through the output port via the coupler (Column 9 lines 19-23).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to have constructed the coupler such that the optical output energy at each of the output ports arise from interference among the optical input energy received at the input ports. Such a design would have been advantageous such that proper coupling would occur in the ring resonator coupler as to correctly embody a fiber ring Fabry-Perot cavity with gain. The necessary coupling among optical energy received at the input ports would allow the device to be used for the intended purpose as a chromatic dispersion compensation apparatus.

Regarding claims 2, 28, Zenteno discloses the active element of the optical amplifier as including a rare-earth active element and a pump source for pumping the rare-earth active element (Column 9 lines 8-12).

Regarding claim 3, 29, Zenteno discloses the rare-earth active element as doped in the feedback path (Column 9 lines 8-12).

Regarding claim 4, 30, Zenteno discloses the rare-earth active element as extending along substantially the entire length of the optical waveguide. The ring resonator is disclosed as "a closed loop made of Erbium (Er) doped polarization maintaining (PM) fiber (Column 9 lines 8-12).

Regarding claim 14, 40, Zenteno discloses the optical amplifier as configured to provide gain to the ring resonator structure (Column 9 lines 8-12). Inherently, the amplifier substantially compensates for resonant losses that arise in the feedback path and NxN network.

Regarding claim 74, Zenteno discloses an embodiment of the invention having a cavity with a plurality of reflectors (Figure 2 element 232).

Regarding claim 77, Zenteno discloses the NxN network as a Gires-Tournois interferometer (Figure 2 element 232; Column 7 lines 6-20).

Claims 1, 5, 15-19, 27, 31, 41-45, 53 are rejected under 35 U.S.C. 103(a) as being unpatentable over Jackel (U.S. Patent No. 6,175,436).

Regarding claims 1, 5, 15, 18, 27, 31, 41, 44 Jackel discloses an optical device having:

an NxN network, where N is an integer greater or equal to 2 having N input ports for receiving optical input energy and N output ports for providing optical output energy (Figure 5 elements 54 and 56);

(N-1) feedback paths optically coupling (N-1) of the input ports of the NxN network to (N-1) of the output orts of the NxN network (Figure 5 element 58);

a first optical waveguide for receiving an input optical signal, said first optical waveguide being coupled to a remaining one of the input ports of the NxN network (Figure 5 element 52);

a second optical waveguide for the exit of an output optical signal, said second optical waveguide being coupled to a remaining one of the output ports of the NxN network (Figure 5 element 52);

an active element selectively supplying gain or loss to optical energy in at least one of the feedback paths (Figure 5 element 60); and

an active element selectively supplying gain or loss to optical energy in the NxN network (Figure 5 element 50).

Jackel fails to disclose the optical output energy at each of the output ports as arising from interference among the optical input energy received at the input ports. Zenteno teaches a coupler (Figure 5 elements 54 and 56) with a coupling ratio determining the portions of the optical signal that are coupled into the feedback path of the ring and the portions that are coupled directly away through the output port via the coupler.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to have constructed the coupler such that the optical output energy at each of the output ports arise from interference among the optical input energy received at the input ports. Such a design would have been advantageous such that proper coupling would occur in the ring resonator coupler as to correctly embody a gained controlled amplifier. The necessary coupling among optical energy received at the input ports would allow the device to be used for the intended purpose as a gain controlled optical amplifier.

Regarding claim 16, 42, Jackel discloses the optical amplifier as including a rare-earth active element and a pump source for pumping the rare-earth active element (Figure 5 element 50).

Regarding claim 17, 43, Jackel discoses the rare-earth active element as doped in at least one waveguide located in the NxN network (Figure 5 element 50).

Regarding claim 19, 45, 53, Jackel discloses the active element as providing gain to the signal carried by the waveguide in the 2x2 coupler. Inherently, the active element compensates for resonant losses and non-resonant losses that arise in the feedback path.

Claims 1, 6-12, 27, 32-38, 54-60, 62-68, 70, 71, 73, 75, 76 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yariv (Patent Application Publication US 2001/0004411).

Regarding claims 1, 27, 54, 62, Yariv discloses an optical device having:

an NxN network, where N is an integer greater or equal to 2 having N input ports for receiving optical input energy and N output ports for providing optical output energy (Figure 19 element 110);

(N-1) feedback paths optically coupling (N-1) of the input ports of the NxN network to (N-1) of the output orts of the NxN network (Figure 19 element 200);

a first optical waveguide for receiving an input optical signal, said first optical waveguide being coupled to a remaining one of the input ports of the NxN network (Figure 19 element a1);

a second optical waveguide for the exit of an output optical signal, said second optical waveguide being coupled to a remaining one of the output ports of the NxN network (Figure 19 element b1); and

an active element selectively supplying gain or loss to optical energy in at least one of the feedback paths (Figure 19 element 200; Paragraph 0075).

Yariv fails to disclose the optical output energy at each of the output ports as arising from interference among the optical input energy received at the input ports. Yariv teaches a coupler (Figure 19 element 110) with a coupling ratio determining the portions of the optical signal that are coupled into the feedback path of the ring and the portions that are coupled directly away through the output port via the coupler (Column 9 lines 19-23).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to have constructed the coupler such that the optical output energy at each of the output ports arise from interference among the optical input energy received at the input ports. Such a design would have been advantageous such that proper coupling would occur in the ring resonator coupler as to correctly embody such a routing and switching device with gain. The necessary coupling among optical energy received at the input ports would allow the device to be used for the intended purpose as a router and switch.

Regarding claim 6, 32, Yariv the active element is inherently configured to substantially compensate for resonant losses that arise in the second optical waveguide (Paragraph 0075). By providing gain to the feedback loop, loss may substantially be compensated in the second waveguide.

Regarding claim 7, 33, 55, 63, Yariv discloses each of the feedback paths and a portion of the NxN network as comprising at least one ring resonator (Paragraph 0058; Figure 19 element 200).

Regarding claim 8, 34, 56, 64, Yariv discloses each of the feedback paths and a portion of the NxN network as comprising a plurality of ring resonators arranged as a ring cascade (Figure 14).

Regarding claim 9, 35, 57, 65, Yariv discloses each of the feedback paths and a portion of the NxN network as comprising a plurality of ring resonators arranged as a ring cascade (Figure 14).

Regarding claim 10, 36, 58, 66, Yariv discloses the NxN network as a 2x2 network (Figure 19 element 116).

Regarding claim 11, 37, 59, 67, Yariv discloses the 2x2 network as a directional coupler (Figure 19 element 116; Figure 20 element 118).

Regarding claim 12, 38, 60, 68, Yariv discloses the 2x2 network as a Mach-Zehnder interferometer (Paragraph 0058).

Regarding claim 70, Yariv discloses the active element as an optical amplifier that includes an electrically pumped semiconductor waveguide (Paragraph 0075).

Regarding claims 71 and 73, Yariv fails to disclose the semiconductor waveguide as an InP-based waveguide. However, Yariv teaches a preferred realization of the switch as having a III-V or II-VI semiconductor material configuration.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to have constructed the switch waveguide as an InP-based waveguide. The use of an

InP-based waveguide is an old and well-known means in the art of obtaining a waveguide which may be electrically pumped. An ordinary artisan would have been motivated to select such a composition for the electrically pumped waveguide in order to obtain the expected results of using such a material as are old and well-known in the art.

Regarding claim 75, Yariv discloses the feedback path as having a photonic band gap structure (Paragraphs 0079 and 0080).

Regarding claim 76, Yariv discloses the band gap structure as including a plurality of a dielectric material for confining optical energy (Paragraph 0075).

Claims 1, 13, 27, 39, 54, 61, 62, 69 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lee et al. (U.S. Patent No. 6,097,529, hereinafter "Lee").

Regarding claims 1, 27, 54, 62, Lee discloses an optical device having:

an NxN network, where N is an integer greater or equal to 2 having N input ports for receiving optical input energy and N output ports for providing optical output energy (Figure 3 elements 1, 2, 3, and 4);

(N-1) feedback paths optically coupling (N-1) of the input ports of the NxN network to (N-1) of the output orts of the NxN network (Figure 3 elements 3 and 4);

a first optical waveguide for receiving an input optical signal, said first optical waveguide being coupled to a remaining one of the input ports of the NxN network (Figure 3 element 1);

a second optical waveguide for the exit of an output optical signal, said second optical waveguide being coupled to a remaining one of the output ports of the NxN network (Figure 3 element 1); and

an active element selectively supplying gain or loss to optical energy in at least one of the feedback paths (Figure 3 element 32).

Lee fails to disclose the optical output energy at each of the output ports as arising from interference among the optical input energy received at the input ports. Lee teaches a coupler with a coupling ratio determining the portions of the optical signal that are coupled into the feedback path of the ring and the portions that are coupled directly away through the output port via the coupler.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to have constructed the coupler such that the optical output energy at each of the output ports arise from interference among the optical input energy received at the input ports. Such a design would have been advantageous such that proper coupling would occur in the coupler as to correctly embody such a modulator as disclosed by Lee. The necessary coupling among optical energy received at the input ports would allow the device to be used for the intended purpose as a modulator with an enhanced extinction ratio.

Regarding claim 13, 39, 61, 69, Lee discloses a variable optical delayer (Figure 3 element 31), constituting an all-pass optical filter.

Claims 15, 20-22, 41, 46-48 are rejected under 35 U.S.C. 103(a) as being unpatentable over Digonnet et al. (U.S. Patent No. 6,356,385, hereinafter "Digonnet".

Regarding claim 15 and 41, Digonnet discloses an optical device having:

an NxN network, where N is an integer greater or equal to 2 having N input ports for receiving optical input energy and N output ports for providing optical output energy (Figure 3A elements 61 and 62));

(N-1) feedback paths optically coupling (N-1) of the input ports of the NxN network to (N-1) of the output orts of the NxN network (Figure 3A);

a first optical waveguide for receiving an input optical signal, said first optical waveguide being coupled to a remaining one of the input ports of the NxN network (Figure 3A element 88);

a second optical waveguide for the exit of an output optical signal, said second optical waveguide being coupled to a remaining one of the output ports of the NxN network (Figure 3A element 63); and

an active element selectively supplying gain or loss to optical energy in the NxN network (Figure 3A element 20).

Digonnet fails to disclose the optical output energy at each of the output ports as arising from interference among the optical input energy received at the input ports. Digonnet teaches a coupler with a coupling ratio determining the portions of the optical signal that are coupled into the feedback path of the ring and the portions that are coupled directly away through the output port via the coupler.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to have constructed the coupler such that the optical output energy at each of the output ports arise from interference among the optical input energy received at the input ports.

Such a design would have been advantageous such that proper coupling would occur in the coupler to enable the device to properly function as an amplifier. The necessary coupling among optical energy received at the input ports would allow the device to be used for the intended purpose as an optical amplifier with modified gain.

Regarding claims 20 and 46, Digonnet discloses the feedback path and a portion of the NxN network as comprising a ring resonator (Column 6 lines 44-48).

Regarding claims 21, 22, 47, and 48, Digonnet fails to disclose a plurality of ring resonators arranged as a cascade or a series of coupled rings. However, the Examiner takes official notice that it is old and well-known in the art of amplifiers and transmission lines to provide amplification to a light signal in a long haul application by positioning of amplifiers, such as disclosed by Digonnet in series.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to have used an amplifer such as disclosed by Digonnet in a long haul transmission line, arranged periodically in series. The use of the amplifier as disclosed by Digonnet would have been motivated by a desire to provide a modified gain amplified signal along points of the optical transmission line. Such an arrangement would have been advantageous to achieve a precisely controlled amplification means.

Claims 15, 23-26, 41, 49-52, 62, and 72 are rejected under 35 U.S.C. 103(a) as being unpatentable over Manning.

Regarding claims 15, 41, and 62, Manning discloses an optical device having:

an NxN network, where N is an integer greater or equal to 2 having N input ports for receiving optical input energy and N output ports for providing optical output energy (Figure 8 elements P1, P2, P3, and P4);

(N-1) feedback paths optically coupling (N-1) of the input ports of the NxN network to (N-1) of the output orts of the NxN network (Figure 8 elements P2 and P4);

a first optical waveguide for receiving an input optical signal, said first optical waveguide being coupled to a remaining one of the input ports of the NxN network (Figure 8 element P1);

a second optical waveguide for the exit of an output optical signal, said second optical waveguide being coupled to a remaining one of the output ports of the NxN network (Figure 8 element P3); and

an active element selectively supplying gain or loss to optical energy in the NxN network (Figure 8 elements SOA 1 and SOA 2).

Manning fails to disclose the optical output energy at each of the output ports as arising from interference among the optical input energy received at the input ports. Manning teaches a coupler with a coupling ratio determining the portions of the optical signal that are coupled into the feedback path of the ring and the portions that are coupled directly away through the output port via the coupler.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to have constructed the coupler such that the optical output energy at each of the output ports arise from interference among the optical input energy received at the input ports. Such a design would have been advantageous such that proper coupling would occur in the

Mach-Zehnder interferometer to enable the device to properly function as a switch. The necessary coupling among optical energy received at the input ports would allow the device to be used for the intended purpose as an optical switch with gain compensation.

Regarding claim 23, 49, Manning discloses the NxN network as a 2x2 network (Figure 8).

Regarding claim 24, 50, Manning discloses the 2x2 coupler as a directional coupler (Figure 3 element 33).

Regarding claim 25, 51, Manning discloses the 2x2 coupler as a Mach-Zehnder interferometer (Column 1 lines 42-55).

Regarding claim 26, 52, Manning discloses the feedback path as a non-linear optical modulator, modulating the phase and amplitude of the feedback signal, constituting an all-pass filter (Column 6 lines 42-65).

Regarding claim 72, Manning discloses the active element as an optical amplifier that includes an electrically pumped semiconductor waveguide (Figure 8).

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

U.S. Patent No. 5,729,388 to Gershenfeld as an alternative 2x2 coupler configuration.

U.S. Patent No. 5,566,261 to Hall et al. as an alternative 2x2 coupler configuration with reflective members in feedback path

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Michael H. Caley whose telephone number is (703) 305-7913. The examiner can normally be reached on M-F 8:30 a.m. - 5:00 p.m..

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Robert Kim can be reached on (703) 305-3492. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 308-7722 for regular communications and (703) 308-7724 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

mhc
February 27, 2003

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